LEVEL

COMPUTATION of AFS
REQUISITIONING OBJECTIVE
for FILL ADDS

OPERATIONS ANALYSIS DEPARTMENT

NAVY FLEET MATERIAL SUPPORT OFFICE

Mechanicsburg, Pennsylvania 17055

Report 141

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COMPUTATION OF AFS REQUISITIONING

OBJECTIVE FOR FILL ADDS

REPORT 141

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ABSTRACT

An AFS supplements the FILL (Fleet Issue Load List) quantity for estab-

lished FILL items by calculating POS (Peacetime Operating Stock) levels which

are based on historical resupply demand on the AFS. For new FILL items (FILL

ADDs), however, the AFS has no recorded historical resupply demand and thus,

no basis for computing POS levels. POS levels for the FILL ADDs can not be

built by the AFS until after the new items are placed in the FILL and the AFS

begins receiving resupply demand from the deployed Fleet for these items. The

inability to immediately compute POS levels for the FILL ADDs could reduce Fleet

support until the AFS receives sufficient demand to build POS levels and until

the AFS receives this additional material. SPCC (Navy Ships Parts Control

Center) maintains historical Fleet resupply demands and thus could build demand-

based levels for the FILL ADDs. This study evaluated the impact of providing an

AFS RO (Requisitioning Objective) quantity in addition to the FILL quantity for

FILL ADDs. Evaluation measures included AFS effectiveness, workload, dollar

value of on-hand excess to the requisitioning objective, and on-hand inventory

investment. The study showed that providing an Atlantic AFS RO quantity for

FILL ADDs resulted in an additional 600 requisitions and 8,000 units satisfied

over a six month deployment. However, this equated to less than one percentage

point increase in effectiveness while excess on-hand dollar value increased

significantly (38-62%). For the Pacific, providing the RO quantity for FILL ADDs

had a negligible impact.

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EXECUTIVE SUMMARY

1. <u>Background and Problem</u>. The FIRL (Fleet Issue Requirements List) is the total PWRMR (Prepositioned War Reserve Material Requirements) for resupply support of the deployed Fleet for *. 90 day endurance period. The FILL (Fleet Issue Load List) is that portion of the FIRL which is stocked on the combat store ships (AFSs) and at designated stock points. The AFS supplements the FILL quantity for <u>established</u> FILL items with POS (Peacetime Operating Stock) levels developed in accordance with SUADPS (Shipboard Uniform Automated Data Processing System) rules. POS levels are built for those established FILL items for which the AFS has received sufficient resupply demand from the deployed Fleet to qualify as a SUADPS demand-based item.

The AFS does not receive resupply demand from the Fleet for non-FILL items. When a <u>new</u> FILL item is added to the AFS, there is a delay between the time of addition to the FILL and the establishment of POS levels for that FILL ADD. The inability to immediately compute POS levels for new FILL items could reduce the effectiveness of the AFS in supporting the deployed Fleet until the AFS receives sufficient demand for the FILL ADD to build POS levels and until the AFS receives the additional material. Since SPCC (Navy Ships Parts Control Center) collects and maintains all historical Fleet demands, SPCC could provide the AFS a demand-based RO (Requisitioning Objective) in addition to the FILL quantity for new FILL items.

2. <u>Objective</u>. The objective of this study was to evaluate the impact of providing the AFS with a demand-based RO, in addition to the FILL quantity, for FILL ADDs. The impact of this additional quantity was measured in terms of requisition and units effectiveness, workload, dollar value of excess on-hand, and on-hand inventory investment.

3. <u>Approach</u>. A simulation program was developed that models the supply procedures of an AFS. A ROQTY (Requisitioning Objective Quantity) was computed using SUADPS rules for all FILL ADDs meeting SUADPS range rules. Assets were then initialized based on the FILL for the benchmark and based on the ROQTY for the alternative loads. Five alternative policies were evaluated against the current policy. These five alternatives consisted of protecting the new ROQTY during a six month deployment for 30, 60, 90, 120, and 150 days. Analyses were performed on the USS SYLVANIA, an Atlantic Fleet AFS, and the USS WHITE PLAINS, a Pacific Fleet AFS.

4. <u>Findings</u>. The addition of a ROQTY had virtually no impact on the Pacific AFS. Analysis showed that over 74% of the USS WHITE PLAINS FILL ADDs had no demand recorded in the ship's files. A major reason for this result is that the Pacific Fleet has access to such sites as NSD Subic Bay and NSD Yokosuka as well as the Pacific AFSs for stock replenishment. SPCC has estimated that a Pacific AFS accounts for only 15% of the total Pacific deployed demand submitted to SPCC.

Providing the USS SYLVANIA with a ROQTY resulted in an additional 600 requisitions and 8,000 units satisfied over a six month deployment. These satisfied demands represent an eight percentage point increase in requisition effectiveness and six percentage points increase in units effectiveness <u>for the FILL ADDs</u>. When considered <u>relative to total AFS performance</u>, however, the ROQTY produced less than a one percentage point change in effectiveness. The addition of a ROQTY reduced AFS resupply orders over the total deployment by 1-5%. However, the ROQTY increased AFS on-hand inventory at the end of the deployment by 4-7%, and increased the value of excess on-hand (on-hand greater

than the RO) by 38-62%. Excess occurred when actual demand less than antici-
pated reduced the RO and a portion of the quantity provided for the initial
ROQTY became excess.

Results from the study indicate that the costs of providing a ROQTY to
the AFS outweigh the benefits.

I. INTRODUCTION

The FIRL (Fleet Issue Requirements List) is the total PWRMR (Prepositioned War Reserve Material Requirements) for resupply support of the deployed Fleet for a 90 day endurance period. A FIRL is developed for each Fleet based on historical demand. The FIRL is segmented into a FIRL ONLY portion that is to be stocked ashore and several FILLs (Fleet Issue Load Lists) that are stocked on the AFSs and at designated stock points. The AFS supplements its FILL quantity with POS (Peacetime Operating Stock) levels developed in accordance with SUADPS (Shipboard Uniform Automated Data Processing System) rules. These rules are described in NAVSUP (Naval Supply Systems Command) Publication 522 (SUADPS-207 Support Procedures).

POS levels are built for a FILL item only if the AFS receives sufficient resupply demand from the deployed Fleet to qualify the item as a SUADPS demand-based item. SUADPS qualifies an item as demand-based if it experiences at least "X" demands in "Y" months, where the parameters "X" and "Y" are controlled by the TYCOM (Type Commander). Currently, Atlantic Fleet AFSs require four demands within 12 months to qualify an item as demand-based while the Pacific Fleet AFSs use a qualification criterion of two demands in six months. An AFS receives resupply demand only for FILL items. Demands for non-FILL items bypass the AFS and are sent directly to a shore-based activity. Thus, prior to an item's addition to the FILL, the AFS will have no recorded resupply demand history for that item and no basis for building POS levels. When a new FILL item (FILL ADD) is added to the AFS, there is a delay between the time of addition to the FILL and the establishment of POS levels on the AFS for that FILL ADD. During this interim time period, the AFS has only the FILL quantity on-hand or on-order, even though a significant number of requisitions may be placed against the AFS for the FILL ADD.

Although historical demand records for a FILL ADD are not available on the AFS, they are collected and maintained at SPCC (Navy Ships Parts Control Center). Thus, it is technically feasible for SPCC to compute an AFS RO (Requisitioning Objective) for FILL ADDs using the SUADPS POS rules and the SPCC data base. The SUADPS RO includes the FILL quantity and could be provided to the AFS at the same time as the FILL quantity. Initializing the FILL ADDs assets at this RO quantity, vice the FILL quantity, could increase the AFS's support of the Fleet during the interim period until an AFS demand history is established and POS levels computed.

FMSO (Navy Fleet Material Support Office) was requested to evaluate the impact of computing an AFS RO quantity for FILL ADDs. Computer simulation was used in the study. The study measured the impact in terms of AFS effectiveness, workload, dollar value of excess on-hand (on-hand greater than RO) and on-hand inventory investment.

Although FILLs are stocked at several designated stock points, the problem addressed above for the AFS does not apply to a stock point. Demand history for both carried and not carried items is collected by the stock points and immediate computation is possible for the establishment of demand-based levels at the stock points. Therefore, this study will only consider the AFS scenario.

II. APPROACH

The impact of initializing levels for a FILL ADD at a demand-based ROQTY (Requisitioning Objective Quantity), vice the FILL quantity, was determined through computer simulation. The simulation program modeled the SUADPS-207 Demand Processing/Levels Computation Program as used by the AFS. Specifically, the simulator duplicated AFS procedures for processing demands, computing POS levels, and ordering and receiving material. These events are described in detail in Appendix A.

The simulator was run for an 18 month period. The 18 month period included 12 months prior to the effective date of a new FILL and six months following the effective date. The first 12 months were used to initialize assets and demand history for established FILL items (i.e., items on both the previous and new FILLs) at representative levels. On the FILL effective date, the FILL ADDs were initialized with assets equal to either the FILL (+ COSAL (Coordinated Shipboard Allowance List) if applicable) or ROQTY. Fffectiveness, workload, and other evaluation measures were then measured over the last six months (approximately the length of a deployment).

The data base, alternative policies, and evaluation measures are described more fully below:

A. <u>DATA BASE.</u> Simulations were performed on two AFSs – one from each Fleet. The Atlantic Fleet test ship was the USS SYLVANIA (AFS-2) while the USS WHITE PLAINS (AFS-4) was used for the Pacific Fleet. All required data except for the ROQTY were obtained from the actual MRFs (Master Record Files) for these test ships. Required data included the FILL quantity, COSAL quantity, unit price, and actual demand history. Profiles of the MRF data bases for the USS SYLVANIA and the USS WHITE PLAINS are shown in Appendix B. The ROQTY was computed using SPCC's MLSF (Mobile Logistics Support Force) historical demand files.

For the USS SYLVANIA, the simulation was keyed to the 1 November 1978 effective date for the 1978 Atlantic FILL. Thus, the simulation ran from November 1977 through April 1979. The ROQTY was computed using the SPCC MLSF deployed demand data for the period January through December 1977. This time period represents the most recent 12 months demand available at SPCC at the time the 1978 Atlantic FILL was constructed. To qualify for the ROQTY, a

FILL ADD must have had at least four deployed demands in the January-December 1977 time period. The ROQTY for the qualifying items was equivalent to the SUADPS POS RO quantity and was computed as:

$$ROQTY = OL + OSTL + MAX (SL, FILL + COSAL)$$

where

OL = Operating Level

OSTL = Order and Shipping Time Level

SL = Safety Level

The OL, OSTL, and SL computations are described in Appendix A.

For the USS WHITE PLAINS, the simulation was keyed to the 1 March 1979 effective date for the 1979 Pacific FILL. Thus, the simulation ran from March 1978 through August 1979. The ROQTY was computed using the SPCC MLSF deployed demand data for the period January through June 1978. This time period represents the most recent six months of demand used in building the 1979 Pacific FILL. SPCC estimates that a Pacific AFS receives about 15% of the total Pacific deployed demand. This percentage was applied to SPCC's total MLSF demands to determine the USS WHITE PLAINS deployed demand data base. To qualify for the ROQTY, a FILL ADD must have had at least two AFS deployed demands in the January-June 1978 time period. As was the case with the USS SYLVANIA, the USS WHITE PLAINS' ROQTY was equivalent to the SUADPS POS RO.

Both deployed and stateside demand are used to build the FIRL/FILL. As noted above, however, only deployed demand was used to build the ROQTY, since this is the only demand that would have been placed against the AFS if the FILL ADD had been an established FILL item.

B. ALTERNATIVE POLICIES. The purpose of the ROQTY was to augment the initial
FILL quantity for FILL ADDs until the AFS collected sufficient demand data to
compute POS levels. In the study simulations, the ROQTY was provided to the
AFS as an initial non-POS load quantity even though SPCC had collected enough
demand from the deployed Fleet to qualify the item for the ROQTY calculation.
In other words, the FILL ADD remained non-POS on the AFS until the AFS received
sufficient demand for the FILL ADD to qualify it as POS. All alternatives
evaluated in this study had an impact on FILL ADDs only when they were non-POS.
The POS range and depth calculations were identical across all alternatives and
were equivalent to those currently used by the AFSs.

Under current (benchmark) procedures, the RO for a non-POS item is equal
to the FILL plus COSAL quantities. For the benchmark, assets for the FILL
ADDs were initialized with this RO quantity at the beginning of deployment. In
addition, replenishment occurred whenever the assets fell below the RO (FILL +
COSAL). For each of the alternatives considered in the study, assets for the
FILL ADDs were initialized with the ROQTY at the beginning of deployment and
replenishment was based on one of five alternative rules. The alternatives
protected the ROQTY by maintaining the RO at the ROQTY, vice FILL plus COSAL,
for specified periods of time. More specifically, the days of protection were
varied in increments of 30 from 30 days to 150 days.

For example, consider the alternative specifying 60 days of protection and
assume a FILL ADD remained non-POS for the entire deployment. Then the FILL
ADD's RO would have been the ROQTY for the first two months of deployment.
During this time period, replenishment occurred whenever the item's assets fell
below the ROQTY. For the remaining four months of deployment, the RO would
have been set equal to the FILL plus COSAL since the ROQTY was no longer

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protected during this time period, and a replenishment would have occurred during these four months only if assets fell below the FILL plus COSAL. FIGURE 1 displays a graphical comparison between the benchmark and the 60 day protection alternative.

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│                                                                   │
│  BENCHMARK - ROQTY not considered for replenishment               │
│                                                                   │
│  ←───────────────── RO = FILL + COSAL ──────────────────→         │
│                                                                   │
│  ┌─────────┬─────────┬─────────┬─────────┬─────────┬─────────┐   │
│  │ MONTH 1 │ MONTH 2 │ MONTH 3 │ MONTH 4 │ MONTH 5 │ MONTH 6 │   │
│  └─────────┴─────────┴─────────┴─────────┴─────────┴─────────┘   │
│                                                                   │
│                                                                   │
│  ALTERNATIVE - ROQTY (OL + OSTL + MAX {SL, FILL + COSAL})         │
│              protected for 60 days of deployment                  │
│                                                                   │
│  ←─ RO = ROQTY ─→ ←──────── RO = FILL + COSAL ──────────→         │
│  ┌─────────┬─────────┬─────────┬─────────┬─────────┬─────────┐   │
│  │ MONTH 1 │ MONTH 2 │ MONTH 3 │ MONTH 4 │ MONTH 5 │ MONTH 6 │   │
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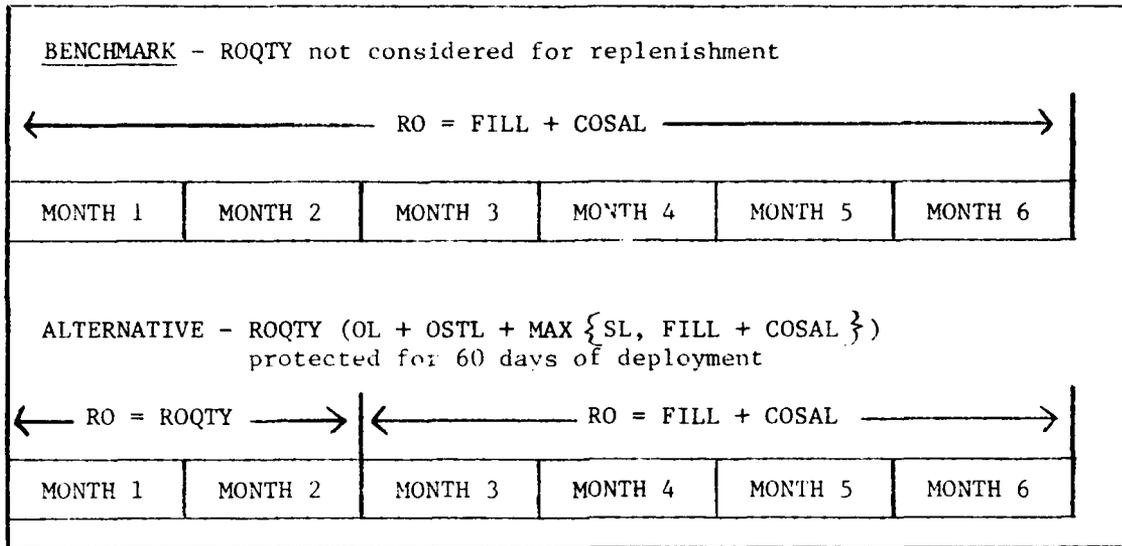
FIGURE 1 - Comparison of Alternative non-POS
RO Calculations

Alternatives that protected the ROQTY for selected periods of time were evaluated since the ROQTY was not intended as a permanent additional level for the FILL ADDs. The ROQTY was intended only to augment the FILL quantity until the AFS built POS levels for the FILL ADD, at which time the ROQTY would no longer be considered. However, if demand for a FILL ADD item did not materialize on the AFS, POS levels would never be built for the FILL ADD. In this case, the absence of sufficient demand to qualify a FILL ADD for POS levels would not warrant maintaining the ROQTY for an indefinite period of time. The alternatives show the impact of protecting the ROQTY over differing fixed periods of time during the deployment.

Protecting the ROQTY for a fixed length of time may increase effectiveness, but may also result in an increased value of excesses (assets greater than RO) immediately after the protection period lapses. More specifically, while the protection period was in effect, the non-POS RO was set to the ROQTY, or OL + OSTL + MIN (SL, FILL + COSAL). In addition, assets (on-hand plus due-in) were maintained at the ROQTY during this period. Once the protection period lapsed, however, the RO was set equal to the FILL plus COSAL, which is by definition smaller than the ROQTY. The assets, which had been maintained at the ROQTY level, would now be compared to a lower RO. Consequently, the value of excesses would increase at this point in time. Depending on when offloading occurred, some of these excesses might be issued for future demand. Offloads were not considered in this study. It is noted that the term excess is defined here as assets greater than the RO, vice the financial definitions used for identifying excess/long supply.

C. <u>EVALUATION MEASURES</u>. The major evaluation measures used in this study are requisition effectiveness, units effectiveness, number of resupply orders, dollar value of excess on-hand, and dollar value of on-hand. These statistics are described below:

- <u>Requisition Effectiveness (Net)</u>. The number of requisitions totally or partially satisfied divided by the number of requisitions placed for FILL items.

- <u>Units Effectiveness (Net)</u>. The number of units satisfied divided by the number of units demanded for FILL items.

- <u>Number of Resupply Orders</u>. The number of resupply orders placed by the AFS.

. <u>Dollar Value of Excess On-Hand</u>. The dollar value of the amount of
on-hand (OH) greater than the RO.

. <u>Dollar Value of On-Hand</u>. The dollar value of the on-hand inventory.

The first three statistics were computed over the entire deployment. The
last two were computed at the end of the deployment. The FIRL/FILL that is
developed by SPCC is segmented by ER (Equipment-Related) and NER (Nonequipment-
Related). Therefore, the statistics in this study were also segmented by ER,
NER, and TOTAL.

III. FINDINGS

Summary range and dollar value statistics for the USS SYLVANIA are shown in
TABLES I - III for all FILL items, FILL ADDs, and FILL ADDs with ROQTY $>$ 0,
respectively. Statistics are shown for items with demand and without demand
during the specified simulation time period. TABLES IV - VI display similar
statistics for the USS WHITE PLAINS.

TABLE I shows that 84% $(\frac{14,032}{16,668})$ of the USS SYLVANIA's FILL items had demand
during the simulation time period. In addition, TABLE II shows that over 65%
$(\frac{3,016}{4,624})$ of the USS SYLVANIA's FILL ADDs had some demand. TABLE III shows that
2,126 of the FILL ADDs (46%) had sufficient deployed demand maintained by SPCC
to qualify for a ROQTY. Of these 2,126 items, 75% (1,605) had demand on the
AFS during the simulation time period.

TABLE IV shows that only 54% $(\frac{10,022}{18,591})$ of the FILL items on the USS WHITE
PLAINS had demand during the simulation time period. Furthermore, TABLE V
shows that only 26% $(\frac{963}{3,757})$ of the USS WHITE PLAINS' FILL ADDs had any demand.
Of the 3,757 FILL ADDs, only 64 had sufficient deployed demand maintained by
SPCC to qualify for the ROQTY. A major reason for the small number of items
with a ROQTY is the relatively low demand experienced by the Pacific AFSs

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compared to the total Pacific Fleet deployed demand. More specifically, while the Atlantic Fleet AFS is the only resupply source for the Sixth Fleet other than CONUS (Continental United States), the Pacific Seventh Fleet has access to sites such as NSD Yokosuka and NSD Subic Bay as well as the Pacific AFSs. SPCC has estimated that a Pacific AFS accounts for only 15% of the total Pacific deployed demand submitted to SPCC.

As a result of the above, simulation of all alternatives on the USS WHITE PLAINS produced only negligible changes from the benchmark. Consequently, further discussion of the various alternatives in this study is limited to the USS SYLVANIA.

TABLE I

Summary of All FILL Items
USS SYLVANIA

Item Category			Items with Demand			Items with No Demand	
ER/NER	FILL Qty	Range	$ FILL (K)	$ ROQTY (K)	Range	$ FILL (K)	$ ROQTY (K)
ER	1	5,076	1,462.0K	523.3K	1,725	953.2K	288.7K
ER	2	1,898	224.1K	5.3K	208	17.3K	.5K
ER	3-5	517	31.6K	.9K	162	21.6K	2.1K
ER	> 5	2,740	1,015.6K	388.1K	402	122.7K	4.6K
ER	Total	10,231	2,733.4K	917.8K	2,497	1,114.7K	295.8K
NER	1	716	33.3K	38.9K	66	62.0K	33.2K
NER	2	554	36.0K	3.6K	6	< .1K	.1K
NER	3-5	149	8.8K	2.1K	9	1.4K	.1K
NER	> 5	2,382	2,736.1K	43.8K	58	27.0K	.1K
NER	Total	3,801	2,814.2K	88.4K	139	90.5K	33.4K
Total	1	5,792	1,495.3K	562.2K	1,791	1,015.3K	321.8K
Total	2	2,452	260.1K	8.9K	214	17.3K	.6K
Total	3-5	666	40.5K	3.1K	171	23.0K	2.1K
Total	> 5	5,122	3,751.7K	432.0K	460	149.7K	4.7K
Total	Total	14,032	5,547.6K	1,006.2K	2,636	1,205.3K	329.2K

Total FILL Items = 16,668

TABLE II

Summary of FILL ADDs
USS SYLVANIA

| Item Category | | Items with Demand | | | Items with No Demand | | |
ER/NER	FILL Qty	Range	$ FILL (K)	$ ROQTY (K)	Range	$ FILL (K)	$ ROQTY (K)
ER	1	1,548	346.0K	523.3K	1,086	187.3K	288.7K
ER	2	196	1.3K	5.3K	115	.3K	.5K
ER	3-5	131	.5K	.9K	85	.5K	2.1K
ER	> 5	700	213.9K	388.1K	266	3.4K	4.6K
ER	Total	2,575	561.7K	917.8K	1,552	191.5K	295.8K
NER	1	191	3.4K	38.9K	42	2.0K	33.2K
NER	2	31	.4K	3.6K	4	<.1K	.1K
NER	3-5	23	.4K	2.1K	3	<.1K	<.1K
NER	> 5	196	34.3K	43.8K	7	<.1K	.1K
NER	Total	441	38.5K	88.4K	56	2.1K	33.4K
Total	1	1,739	349.4K	562.2K	1,128	189.3K	321.8K
Total	2	227	1.7K	8.9K	119	.3K	.6K
Total	3-5	154	.9K	3.1K	88	.5K	2.1K
Total	> 5	896	248.2K	432.0K	273	3.4K	4.7K
Total	Total	3,016	600.2K	1,006.2K	1,608	193.6K	329.2K

Total FILL ADDs = 4,624

TABLE III

Summary of FILL ADDs with ROQTY > 0
USS SYLVANIA

| Item Category | | Items with Demand | | | Range | Items with No Demand | |
ER/NER	FILL Qty	Range	$ FILL (K)	$ ROQTY (K)		$ FILL (K)	$ ROQTY (K)
ER	1	687	138.1K	523.3K	349	76.2K	288.7K
ER	2	76	.7K	5.3K	37	.1K	.5K
ER	3-5	53	.2K	.9K	26	.4K	2.1K
ER	> 5	401	202.3K	388.1K	98	2.2K	4.6K
ER	Total	1,217	341.3K	917.8K	510	78.9K	295.8K
NER	1	159	2.4K	38.9K	5	.2K	33.2K
NER	2	30	.4K	3.6K	3	<.1K	.1K
NER	3-5	23	.4K	2.1K	1	<.1K	<.1K
NER	> 5	176	30.5K	43.8K	2	<.1K	.1K
NER	Total	388	33.6K	88.4K	11	.3K	33.4K
Total	1	846	140.5K	562.2K	354	76.4K	321.8K
Total	2	106	1.1K	8.9K	40	.1K	.6K
Total	3-5	76	.5K	3.1K	27	.5K	2.1K
Total	> 5	577	232.8K	432.0K	100	2.2K	4.7K
Total	Total	1,605	374.9K	1,006.2K	521	79.2K	329.2K

Total FILL ADDs with ROQTY > 0 = 2,126

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TABLE IV

Summary of All FILL Items
USS WHITE PLAINS

Item Category		Items with Demand			Items with No Demand		
ER/NER	FILL Qty	Range	$ FILL (K)	$ ROQTY (K)	Range	$ FILL (K)	$ ROQTY (K)
ER	1	2,875	878.9K	0K	4,725	1,715.5K	4.1K
ER	2	283	44.1K	0K	429	10.1K	0K
ER	3-5	367	71.3K	0K	663	32.1K	0K
ER	> 5	3,310	802.3K	36.2K	2,384	94.9K	.1K
ER	Total	6,835	1,796.7K	36.2K	8,201	1,852.6K	4.2K
NER	1	137	14.8K	0K	60	6.0K	0K
NER	2	4	.1K	0K	5	1.8K	0K
NER	3-5	36	6.6K	0K	27	4.1K	.2K
NER	> 5	3,010	2,752.7K	18.2K	276	68.4K	2.7K
NER	Total	3,187	2,774.2K	18.2K	368	80.3K	2.9K
Total	1	3,012	893.7K	0K	4,785	1,721.5K	4.1K
Total	2	287	44.2K	0K	434	11.9K	0K
Total	3-5	403	77.9K	0K	690	36.2K	.2K
Total	> 5	6,320	3,555.0K	54.4K	2,660	163.3K	2.8K
Total	Total	10,022	4,570.8K	54.4K	8,569	1,932.9K	7.1K

Total FILL Items = 18,591

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TABLE V

Summary of FILL ADDs
USS WHITE PLAINS

Item Category		Items with Demand				Items with No Demand	
ER/NER	FILL Qty	Range	$ FILL (K)	$ ROQTY (K)	Range	$ FILL (K)	$ ROQTY (K)
ER	1	418	181.7K	0K	1,497	593.0K	4.1K
ER	2	31	.6K	0K	108	.8K	0K
ER	3-5	52	.8K	0K	255	2.7K	0K
ER	> 5	235	50.3K	36.2K	799	30.9K	.1K
ER	Total	736	233.4K	36.2K	2,659	627.4K	4.2K
NER	1	0	0K	0K	5	.1K	0K
NER	2	0	0K	0K	0	0K	0K
NER	3-5	6	.1K	0K	12	1.6K	.2K
NER	> 5	221	97.6K	18.2K	118	27.8K	2.7K
NER	Total	227	97.7K	18.2K	135	29.5K	2.9K
Total	1	418	181.7K	0K	1,502	593.1K	4.1K
Total	2	31	.6K	0K	108	.8K	0K
Total	3-5	58	.9K	0K	267	4.3K	.2K
Total	> 5	456	147.9K	54.4K	917	58.7K	2.8K
Total	Total	963	331.2K	54.4K	2,794	656.9K	7.1K

Total FILL ADDs = 3,757

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TABLE VI

Summary of FILL ADDs with ROQTY > 0
USS WHITE PLAINS

Item Category		Items with Demand			Items with No Demand		
ER/NER	FILL Qty	Range	$ FILL (K)	$ ROQTY (K)	Range	$ FILL (K)	$ ROQTY (K)
ER	1	0	0K	0K	8	1.3K	4.1K
ER	2	0	0K	0K	0	0K	0K
ER	3-5	0	0K	0K	0	0K	0K
ER	> 5	8	30.8K	36.2K	4	.1K	.1K
ER	Total	8	30.8K	36.2K	12	1.4K	4.2K
NER	1	0	0K	0K	0	0K	0K
NER	2	0	0K	0K	0	0K	0K
NER	3-5	0	0K	0K	1	.1K	.2K
NER	> 5	33	15.9K	18.2K	10	2.2K	2.7K
NER	Total	33	15.9K	18.2K	11	2.3K	2.9K
Total	1	0	0K	0K	8	1.3K	4.1K
Total	2	0	0K	0K	0	0K	0K
Total	3-5	0	0K	0K	1	.1K	.2K
Total	> 5	41	54.4K	54.4K	14	2.2K	2.8K
Total	Total	41	54.4K	54.4K	23	3.7K	7.1K

Total FILL ADDs with ROQTY > 0 = 64

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The impact of providing a ROQTY for the FILL ADDs was evaluated in terms of total FILL performance and in terms of the performance of the FILL ADDs. All statistics are based on the total six month deployment.

A. TOTAL FILL PERFORMANCE. TABLE VII displays the alternative ROQTY policies for the USS SYLVANIA considering all FILL items. The table shows that neither requisition effectiveness nor units effectiveness improved by more than one percentage point across all alternatives and across ER, NER, and TOTAL. TABLE VII also shows that the number of orders decreased from 1% to 5% across the alternatives, with the decrease fairly evenly distributed between ER and NER items. The dollar value of material excess to the RO at the end of the simulation increased significantly across all the alternatives. Increases ranged from 38% ($.5M) for the 30 day protection alternative to 62% ($.8M) for the 150 day protection alternative. The impact on excess dollar value was most apparent for ER items, where increases ranged from 125% to 175%. Further analysis showed that a total of 1,724 FILL ADDs each had a ROQTY exceeding that item's total units demanded for the six month deployment. The 1,724 items represent 81% of the FILL ADDs with a ROQTY. On-hand inventory dollar value increased from 4% for the 30 day protection alternative to 7% for the 150 day alternative. The ER FILL items accounted for virtually all of these increases.

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TABLE VII

Impact of ROQTY Alternatives – Relative to Total FILL Items
Six Month Deployment

Item Category	Alternatives	RQN Eff	Units Eff	Orders		Excess Items		On-Hand	
				NR	ΔZ	$	ΔZ	$	ΔZ
T O T A L	Benchmark	90.3%	93.3%	24,340	–	1.3M	–	13.5M	–
	30 day protection	+ .7%	+ 0%	− 1,286	−5%	+ .5M	+38%	+ .6M	+4%
	60 day protection	+ .7%	+ 0%	− 889	−4%	+ .6M	+46%	+ .7M	+5%
	90 day protection	+ .7%	+ 0%	− 672	−3%	+ .6M	+46%	+ .7M	+5%
	120 day protection	+ .7%	+ 0%	− 328	−1%	+ .7M	+54%	+ .9M	+7%
	150 day protection	+ .7%	+ 0%	− 296	−1%	+ .8M	+62%	+ .9M	+7%
E R I T E M S	Benchmark	90.3%	92.3%	14,251	–	.4M	–	5.9M	–
	30 day protection	+ .9%	+ .1%	− 914	−6%	+ .5M	+125%	+ .5M	+8%
	60 day protection	+ 1.0%	+ .1%	− 638	−4%	+ .5M	+125%	+ .5M	+8%
	90 day protection	+ 1.0%	+ .1%	− 494	−3%	+ .5M	+125%	+ .5M	+8%
	120 day protection	+ 1.0%	+ .1%	− 219	−2%	+ .7M	+175%	+ .7M	+12%
	150 day protection	+ 1.0%	+ .1%	− 194	−1%	+ .7M	+175%	+ .7M	+12%
N E R I T E M S	Benchmark	90.4%	93.7%	10,089	–	.8M	–	7.6M	–
	30 day protection	.6%	+ 0%	− 372	−4%	+ 0M	+ 0%	+ 0M	+0%
	60 day protection	.6%	+ 0%	− 251	−2%	+ 0M	+ 0%	+ 0M	+0%
	90 day protection	.6%	+ 0%	− 178	−2%	+ 0M	+ 0%	+ 0M	+0%
	120 day protection	.6%	+ 0%	− 109	−1%	+ 0M	+ 0%	+ 0M	+0%
	150 day protection	.6%	+ 0%	− 102	−1%	+ 0M	+ 0%	+ 0M	+0%

Range of FILL Items:

ER – 10,231
NER – 3,801
Total – 14,032

B. __FILL ADDS ONLY__. TABLE VIII displays the alternative ROQTY policies for the USS SYLVANIA considering FILL ADDs only. Since the alternatives only had an impact on FILL ADDs, the differences from the benchmark shown in TABLE VIII are a larger magnitude than those shown in TABLE VII for all FILL items.

TABLE VIII shows that requisition effectiveness for the FILL ADDs increased by over eight percentage points and units effectiveness increased by over six percentage points across all alternatives. The table shows that in terms of requisition effectiveness, the additional ROQTY had the biggest impact on NER FILL ADDs. The increases in requisition effectiveness ranged from 10.6 to 11.2 percentage points for NER FILL ADDs, but only 6.3 to 6.9 percentage points for the ER FILL ADDs. The differences between ER and NER FILL ADDs are less pronounced for units effectiveness and resupply orders. In terms of excess dollar value and on-hand dollar value, the ER FILL ADDs had much larger increases in magnitude than the NER FILL ADDs.

TABLE VIII

Impact of ROQTY Alternatives - Relative to FILL ADDs Only

Six Month Deployment

Item Category	Alternatives	RQN Eff	Units Eff	Orders		Excess Items		On-Hand	
				NR	Δ%	$	Δ%	$	Δ%
T O T A L	Benchmark	81.2%	65.4%	4,512	-	.03M	-	.8M	-
	30 day protection	+ 8.0%	+ 6.0%	-1,286	-29%	+.5M	+1667%	+.6M	+75%
	60 day protection	+ 8.6%	+ 6.9%	- 889	-20%	+.6M	+2000%	+.7M	+88%
	90 day protection	+ 8.6%	+ 7.0%	- 672	-15%	+.6M	+2000%	+.7M	+88%
	120 day protection	+ 8.7%	+ 7.0%	- 328	- 7%	+.7M	+2333%	+.9M	+113%
	150 day protection	+ 8.7%	+ 7.0%	- 296	- 7%	+.8M	+2667%	+.9M	+113%
E R I T E M S	Benchmark	80.8%	53.4%	3,394	-	.03M	-	.7M	-
	30 day protection	+ 6.3%	+ 6.4%	- 914	-27%	+.5M	+1667%	+.5M	+71%
	60 day protection	+ 6.8%	+ 7.7%	- 638	-19%	+.5M	+1667%	+.5M	+71%
	90 day protection	+ 6.8%	+ 7.7%	- 494	-15%	+.5M	+1667%	+.5M	+71%
	120 day protection	+ 6.9%	+ 7.9%	- 219	- 6%	+.7M	+2333%	+.7M	+100%
	150 day protection	+ 6.9%	+ 7.9%	- 194	- 6%	+.7M	+2333%	+.7M	+100%
N E R I T E M S	Benchmark	81.8%	78.5%	1,118	-	.001M	-	.1M	-
	30 day protection	+10.6%	+ 5.4%	- 372	-33%	+ 0M	+ 0%	+ 0M	+ 0%
	60 day protection	+11.2%	+ 6.0%	- 251	-22%	+ 0M	+ 0%	+ 0M	+ 0%
	90 day protection	+11.2%	+ 6.0%	- 178	-16%	+ 0M	+ 0%	+ 0M	+ 0%
	120 day protection	+11.2%	+ 6.0%	- 109	-10%	+ 0M	+ 0%	+ 0M	+ 0%
	150 day protection	+11.2%	+ 6.0%	- 102	- 9%	+ 0M	+ 0%	+ 0M	+ 0%

Range of FILL ADDs:

ER - 2,575
NER - 441
TOTAL - 3,016

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As discussed previously, the FILL ADDs show a larger impact from adding a ROQTY than do all the FILL items. This is due to the much larger data base associated with all FILL items as compared to FILL ADDs only. For example, a total of 89,130 requisitions and 14,570,554 units were demanded over the USS SYLVANIA's six month deployment. Only 8,114 requisitions and 139,756 units were demanded across the entire deployment for FILL ADDs. To put the impact on requisition and units effectiveness into perspective, TABLE IX displays the impact of the various alternatives in terms of the changes in the number of requisitions and units satisfied over the USS SYLVANIA's deployment. TABLE IX shows that all of the alternatives increased the number of requisitions satisfied over the entire deployment by over 600, or an average of over 100 additional satisfied requisitions per month. Over 8,000 additional units were satisfied for the entire deployment across all the alternatives. The increases in the number of requisitions and units satisfied were fairly evenly split between ER and NER items.

TABLE IX

Number of Requisitions/Units Satisfied Entire Deployment

Item Category	Alternatives	Requisitions Satisfied	Units Satisfied
T O T A L	Benchmark	80,511	13,590,330
	30 day protection	+655	+8,347
	60 day protection	+697	+9,578
	90 day protection	+702	+9,663
	120 day protection	+708	+9,769
	150 day protection	+708	+9,769
	Maximum protection	+708	+9,769
E R I T E M S	Benchmark	30,074	4,080,140
	30 day protection	+305	+4,685
	60 day protection	+330	+5,573
	90 day protection	+332	+5,615
	120 day protection	+338	+5,716
	150 day protection	+338	+5,716
	Maximum protection	+338	+5,716
N E R I T E M S	Benchmark	50,437	9,510,190
	30 day protection	+350	+3,662
	60 day protection	+367	+4,005
	90 day protection	+370	+4,048
	120 day protection	+370	+4,053
	150 day protection	+370	+4,053
	Maximum protection	+370	+4,053

IV. SUMMARY

When a new FILL item is added to the AFS, there is a delay between the
time of addition to the FILL and the establishmentof POS levels on the AFS
for that new FILL item. This delay could have a detrimental effect on Fleet
support during that interim time period. Consequently, this study measured
the impact of providing the AFS with a demand-based quantity in addition to
the FILL quantity for FILL ADDs. Evaluation measures included requisition
and units effectiveness, workload, dollar value of excess, and on-hand inven-
tory investment.

The major results for the USS SYLVANIA across all alternatives are shown below:

. 46% of the FILL ADDs had sufficient SPCC maintained demand to qualify for ROQTY calculations.

. 75% of the FILL ADDs with a ROQTY experienced demand during the USS SYLVANIA's deployment.

. Addition of a ROQTY resulted in the AFS satisfying over 600 additional requisitions and 8,000 additional units during a six month deployment. These satisfied demands equated to an eight percentage point increase in requisition effectiveness and a six point increase in unit effectiveness for the FILL ADD items. However, when considered relative to total AFS performance, the ROQTY produced less than one percentage point change in effectiveness.

. Addition of a ROQTY reduced AFS resupply orders over the total deployment by 1-5%.

. Addition of a ROQTY increased the AFS on-hand inventory at the end of the deployment by 4-7% ($.6M - .9M above the $13.5M value for the current rules). The dollar value of on-hand material above the RO increased 38-62% ($.5M - .8M above the $1.3M value for the current rules).

. 81% of the FILL ADDs with a ROQTY had a ROQTY exceeding that item's total units demanded for the six month deployment. The ROQTY was computed using actual AFS rules/parameters for a demand-based POS quantity.

In conclusion, providing an Atlantic AFS with a demand-based quantity in addition to the FILL quantity for FILL ADDs increased the number of requisitions satisfied by an average of over 100 a month and increased the number of units satisfied by over 1,300 a month. However, this equated to less than one

percentage point increase in effectiveness and resulted in an increase ($.5M - .8M) in the value of on-hand excess to the RO. Providing a ROQTY for FILL ADDs on the Pacific AFS had negligible impact on cost or effectiveness. It appears from this study that the cost of providing a ROQTY to the AFS outweighs the benefits.

APPENDIX A: SIMULATION MODEL DESCRIPTION

The alternative policies in this study were evaluated through the use of
a computer simulation program modeling the SUADPS (Shipboard Uniform Auto-
mated Data Processing System)-207 demand processing/levels computation pro-
gram. The supply procedures of an AFS were incorporated into the program.

Initially, each item was designated non-POS (Peacetime Operating Stock).
The RO (Requisitioning Objective) and OH (On-Hand) quantity for each item
coded by the AFS for fixed levels were initialized at the RO quantity in the
ship's MRF (Master Record File). For all other items, the RO and OH quantity
were set equal to the allowance quantity on the MRF. For established FILL
(Fleet Issue Load List) items (items on the previous and new FILLs), the
allowance quantity was set equal to the FILL plus COSAL (Coordinated Shipboard
Allowance List) quantity. For FILL ADDs, the allowance quantity was the
COSAL quantity prior to the new FILL implementation date. After this date,
the allowance quantity for the FILL ADDs was the FILL plus COSAL quantity.
The first 12 months of demand for each of the two test ships were used as an
initialization period. The final six months of demand history from the MRF
were used for evaluation purposes.

The major events of the simulator are described in the following paragraphs:

1. _Event: Demand._ This event occurred whenever a demand was placed
against the AFS's inventory. The two major data elements needed for proces-
sing were the date of the demand and the demand quantity. Both of these data
elements were developed from the ship's MRF demand history. During this
event, material, if available, was issued and effectiveness statistics were
gathered.

2. Event: Inventory Review (POS and ROQTY (Requisitioning Objective Quantity) Calculations). This event occurred every 30 days. During this event, an item's past demand history was reviewed to determine the POS status of the item. To qualify as POS, or for the ROQTY, an item must have met certain frequency of demand criteria. For example, the USS SYLVANIA used a criteria calling for four demand frequencies in 12 months to qualify an item as POS and two demand frequencies in 12 months to remain POS. The USS WHITE PLAINS criteria were two demands in six months to qualify and one demand in six months to remain.

Once an item's POS status was determined, the appropriate inventory levels were computed. The benchmark inventory levels are defined below and are further described in NAVSUP (Naval Supply Systems Command) Publication 522 (SUADPS-207 Support Procedures).

. OSTL (Order and Shipping Time Level) is a level of stock computed to satisfy the average demand rate during the anticipated time between the placement of a resupply order and receipt of the material. However, due to the unique operating procedures of an AFS, each Fleet has authorized that no OSTL be computed for the AFSs.

. SL (Safety Level) is a level of buffer stock intended to provide protection against random increases of demand that could cause the item to become NIS (Not-In-Stock). The SL was set equal to two times the AMD (Average Monthly Demand), or 60 days of stock. If this computed SL was less than the FILL plus COSAL (Coordinated Shipboard Allowance List) quantities, the SL was set equal to this sum. The SL was only computed for POS items.

. <u>OL (Operating Level)</u> is a layer of stock from which the AFS conducts
its normal peacetime supply operations. The SUADPS levels setting
program uses the EOQ (Economic Order Quantity) concept. The EOQ
formula considers the AMD, UP (Unit Price), OLMF (Operating Level
Multiplier Factor), and MAX/MIN (Maximum/Minimum months of supply)
constraints. The OL = OLMF x $\sqrt{\dfrac{AMD}{UP}}$. The OL was constrained be-
tween MIN x AMD and MAX x AMD. An OLMF of 10.0, a MAX of 5.0 months,
and a MIN of 2.0 months were used for both the USS SYLVANIA and the
USS WHITE PLAINS. The OL was only computed for POS items.

. <u>RO (Requisitioning Objective)</u> is the maximum authorized level of on-
hand plus due-in stock. For a non-POS item, the RO equals the FILL
plus COSAL quantities. The RO for a POS item equals the sum of the
OL, SL, and OST levels. The ROQTY used in the alternatives considered
in this study was calculated using the same rules as the RO computation
for POS items on the AFS. However, the ROQTY was provided to the AFS
as a non-POS quantity since the AFS did not receive the demand to
build demand levels. Any item for which a limit flag was in the MRF
was assigned the same RO as on the MRF and treated as non-POS.

. <u>RP (Reorder Point)</u> is the asset level (on-hand plus due-in) at or below
which a resupply order is initiated. For a non-POS item, the RP is
one unit less than the RO. For a POS item, the RP equals the OSTL plus
SL.

It is noted that the FILL quantity, which is used in several of the in-
ventory levels described above, was considered for all FILL items after the
new FILL was applied to the AFS's MRF, i.e., after the FILL implementation
date. Prior to this implementation date, the FILL quantity was used for es-
tablished FILL items but not for the FILL ADDs. This was done since the FILL
ADDs were not carried by the AFS as FILL items prior to the implementation date.

3. <u>Event: Asset Review</u>. This event occurred every 30 days after the inventory review event. In this event, an item's assets (on-hand plus due-in) were compared to the RP. If the assets were less than or equal to the RP, a resupply order was placed for that item. The quantity was equal to the difference between the RO and the assets.

4. <u>Event: TOPOFF</u>. This event occurred at the implementation date when the new FILL was applied to the AFS's MRF record. This event occurred two or more months prior to the start of the deployment. During this event, an item's assets were compared to the RO. If the assets were less than the RO, a resupply order was placed to bring that item's assets up to the RO. The purpose of this event was to insure that the AFS would have as much of the FILL material on-hand as possible at the time of deployment.

5. <u>Event: Receipt</u>. This event occurred upon the arrival of a resupply order placed in "Asset Review" or "TOPOFF". The receipt time, defined as the time from the placing of an order to its arrival, was set at 30 days for both the USS SYLVANIA and the USS WHITE PLAINS.

6. <u>Event: Snapshot</u>. This event collected statistics so a review of the system could be taken at arbitrary points of time during the simulation.

APPENDIX B: PROFILE OF AFS DATA BASE

This study considered only the FILL items carried on an AFS. FILL items are identified by an allowance type code of 2 or 3. For information purposes, however, profiles of the entire data base for the USS SYLVANIA and the USS WHITE PLAINS are given below. The allowance type codes are further described in NAVSUP (Naval Supply Systems Command) Publication 522 (SUADPS (Shipboard Uniform Automated Data Processing System)-207 Support Procedures).

TABLE B-1

Profile of AFS Data Base

Allowance Type Code	Description	USS SYLVANIA Range	USS WHITE PLAINS Range
1	COSAL Item	6,964	7,365
2	FILL Item	13,640	15,036
3	COSAL and FILL Item	3,028	3,555
4	POS Item	136	59
5	Miscellaneous Load	4,491	3,286
6	Excess	307	1,512
7	Economic Retention	2,847	151
8	Not carried - demand recording only	1,508	4,490
9	Substitute	891	1,450
Total		33,812	36,904

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13. ABSTRACT

An AFS supplements the FILL (Fleet Issue Load List) quantity for established FILL items by calculating POS (Peacetime Operating Stock) levels which are based on historical resupply demand on the AFS. For new FILL items (FILL ADDs), however, the AFS has no recorded historical resupply demand and thus, no basis for computing POS levels. POS levels for the FILL ADDs can not be built by the AFS until after the new items are placed in the FILL and the AFS begins receiving resupply demand from the deployed Fleet for these items. The inability to immediately compute POS levels for the FILL ADDs could reduce Fleet support until the AFS receives sufficient demand to build POS levels and until the AFS receives this additional material. SPCC (Navy Ships Parts Control Center) maintains historical Fleet resupply demands and thus could build demand-based levels for the FILL ADDs. This study evaluated the impact of providing an AFS RO (Requisitioning Objective) quantity in addition to the FILL quantity for FILL ADDs. Evaluation measures included AFS effectiveness, workload, dollar value of on-hand excess to the requisitioning objective, and on-hand inventory investment. The study showed that providing an Atlantic AFS RO quantity for FILL ADDs resulted in an additional 600 requisitions and 8,000 units satisfied over a six month deployment. However, this equated to less than one percentage point increase in effectiveness while excess on-hand dollar value increased significantly (38-62%). For the Pacific, providing the RO quantity for FILL ADDs had a negligible impact.